

## IDENTIFYING CRITICAL FACTORS AFFECTING BEHAVIOR OF CATTLE FARMERS IN CAMBODIA USING OLS REGRESSIONS

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### ABSTRACT

*The scale of cattle maintained by rural farmer has a lot to do with the farmers' perception on factors that limits or encourages them to change the scale of their stock. These influences on cattle scale are captured in 6 districts of Battambang province of Cambodia. Data collected were analyzed using two equations and each with two different models. The result of the models depicted one common factor (the size of cultivated land) being highly significant and positively related to the scale of cattle raised by farmers. Other significant factors include the age of the household head, the number of laborers in the family and education of the household head. This study is of great assistance to extension officer and policy makers on effective way to improve the livestock subsector in the rural region.*

**KEYWORDS:** Farmers Behavior, Cattle, Battambang Province, Cambodia

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### INTRODUCTION

With increase in standard of living, the desire for meat increases thus aggregate demand increases pushing farmers' behavior to increase their livestock production. Over 80% of Cambodian population is dominated by small-scale farmers that reside in the rural area, majorly depending on agriculture for food and income (NSDP, 2015). Raising livestock is the second most important agricultural activity undertaken by the farmers after crop farming which plays a key role in supporting both human and livestock. As at 2015 census, about 75 percent (1.6 million) of all household farmers in Cambodia raise livestock (CAC, 2015) and rice farming and cattle production were the main contributions to household income. Fattening of cattle is a potential business opportunity for small and medium enterprise, capable of significantly increasing their income (Samkol, 2015). Cattle are majority kept to providing income, draught power and as family 'asset bank' for rural households in Cambodia (Bush et al. 2014). Cattle productivity becomes paramount to poverty reduction and this could be met by improvement of nutritional composition of their feed. Improved cattle feed has been one of the major constraints to small-scale farmers to achieving optima cattle productivity (Young et al. 2014). In Cambodia, the small-scale cattle feed majorly compose of natural pasture, leftover farm residues most especially rice straw (Darith et al. 2016). Feed structure changes seasonally i.e. rainy and dry season (dry or fresh feed system) (Stür and Horne 1991 and 2001; Pen et al. 2010 and Darith et al. 2016).

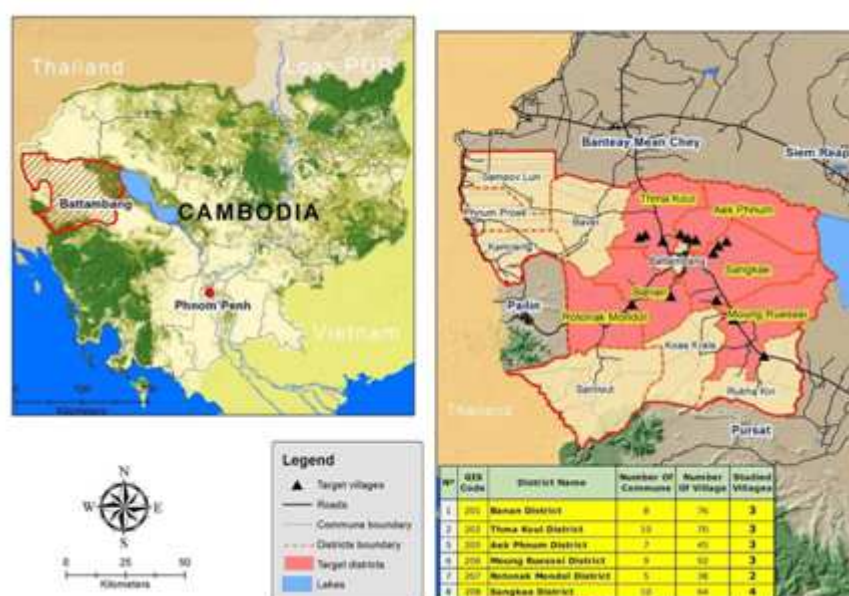
The rural farmers mostly practice the traditional techniques of raising cattle which result in slow growth rate and susceptible to diseases, in whole leading to poor productivity. More so, limited land due to private

owner-ship has in many ways hindered the feed source of cattle. As for the labor force, there has been migration of active laborers to other countries which pays higher thus leaving the household members (usually the older people) to cater for the livestock farming. The present study is to analysis factors that influence farmer behavior to change their cattle scale. The results of the study can provide appropriate strategies to policy makers on how to effectively develop cattle production given the perspective of the farmers.

## METHODOLOGY

### Data Resource

Six districts in Battambang province in Cambodia were surveyed using standard questionnaire. About 197 household rearing cattle were interviewed. The collection of data was conducted by the authors, postgraduate students of AII-CAAS, graduate students of UME and RUA. The selected province Battambang is located in northwestern Cambodia and is one of province included in the Tonle Sap reservoir; and it's well known to have vast land for rice cultivation and some other grains which are one of the major feed components used by the Cambodian farmer



### Data Description

**Table 1** below depict the demographic information of the household head (farmer) such as: the years of education, age, gender, family size, labor size, number of children, off-farm job, area and net income in six selected districts. On average the household head age is 45 years; further statistics shows that the household head aged above 45 years tend to rear more cattle than those below 45 years entailing that farmers with more experience with age are inclined to rear more cattle. On average, farmers with education level above grade five have 7.5 cattle compared to farmers with grade five and below 7.2. Male household head have for cattle than the female household head although with little difference. The average household size is about 5 persons consisting of 3 or more laborers; the statistics shows that farmers with more laborers have more cattle, compare to those with lesser laborers. The family labor forces are mostly children or in some cases hired labor. Off-farm job are other job a household laborer embark on outside the family farm usually with the aim of bringing the earning back home. The farmers with off-farm jobs have more cattle than those without because they provide extra income to the farm which could be used to take care or even increase the number of cattle.

**Table 1: Descriptive Statistics of Mean and Group of Variables**

Variables	Definitions	Mean	Group	Cattle	
				Sample	Mean
<i>edu</i>	Household head's (farmer) education	grade 5	> 5	87	7.5
			≤ 5	110	7.2
<i>age</i>	Household head's (farmer) age	45 year	> 45	106	8.0
			≤ 45	91	6.5
<i>dum_sex</i>	Dummy variable: 1=male; 0=female for household head	---	1	164	7.3
			0	33	7.0
<i>sizfami</i>	Household head's (farmer) family size	5	> 5	43	7.0
			≤ 5	154	7.4
<i>sizlabor</i>	Labour size per household	3	> 3	65	8.9
			≤ 3	132	6.5
<i>sizchild</i>	Number of children in household including Uni. Student	2	> 2	44	5.9
			≤ 2	153	7.7
<i>dum_offarm</i>	Dummy variable: 1=Labour off-farm job in household; 0=others	---	1	34	7.9
			0	163	7.2
<i>area</i>	Household head total land holding	3 ha	> 3	54	8.5
			≤ 3	143	6.8
<i>income</i>	Annual income of household head (*1000riel)	4000 riel (\$1000)	> 4000	56	8.3
			≤ 4000	141	6.9
<i>_Idistrict_i</i>	string variable, totally it includes 6 districts in the survey; i=1,2,.....,6	----	Aek Phnum	39	5.1
			Banan	30	8.2
			Moung Ruessei	37	6.3
			Ratanak Mondol	20	9.7
			Sangkae	44	8.1
			Thma Koul	27	7.7

On average, each household have an approximate of 3 hectares of land for rice production and those with bigger land size have more cattle as shown in the table below. Income is important source to proper management of not only the farm but the family such as the children education, feeding and other social activities. Each household farmer earns about 4,000,000riel equivalent to \$1,000 per year. Majority of the farmers (71.6%) rearing cattle earns less than \$1000 per year and for those who earns more, have on average more cattle than those with less.

**Table 2: The Descriptive Acronyms of Logarithm Variables**

<i>lnedu</i>	Logarithm of household's education
<i>lnage</i>	Logarithm of household's age
<i>lnsizlabor</i>	Logarithm of size labor
<i>lnsizchild</i>	Logarithm number of children
<i>lnsizfami</i>	Logarithm of size family
<i>lnincome</i>	Logarithm of household's income
<i>lnarea</i>	Logarithm of land area

### The Model Design and Variable Definition

Data analysis was carried out with the use of STATA software by applying logistic regression model in this study and expressing the relationship between cattle scale which farmers keep and the demographic and socioeconomic aspect of the household. The econometric analysis is shown in 4 constructed models below:

#### Model 1 And 2 Regression without Translog

$$Q_c = \beta_0 + \beta_1 edu + \beta_2 age + \beta_3 dum\_sex + \beta_4 sizfami + \beta_5 sizlabor + \beta_6 sizchild + \beta_7 dum\_offarm + \beta_8 area + \beta_9 income + \varepsilon_i \quad (1)$$

The definition of each variable in the above equation (1) is explained in **table 1 and table 2**. Model (1) make a regression analysis on the whole sample through the regression equation (1) which the  $\beta_0$  is the constant and  $\beta_1, \dots, \beta_9$  are the coefficients of parameters of the econometric model that demonstrated the direction and strengths of the relationship between  $Q_c$  and the demographic and socioeconomic factors of the household farmers while the  $\varepsilon_i$  is explain the error term assumed to be distributed logistic. Model (1) is the direct running of the regression (equation 1), while model (2) is the stepwise OLS (ordinary least square) regression of equation (1).

**Model 3 and 4 Regression with Translog:**

$$Q_c = \beta_0 + \beta_1 \ln edu + \beta_2 \ln age + \beta_3 \text{dum\_sex} + \beta_4 \ln \text{sizfami} + \beta_5 \ln \text{sizlabor} + \beta_6 \ln \text{sizchild} + \beta_7 \text{dum\_offarm} + \beta_8 \ln \text{area} + \beta_9 \ln \text{income} + \varepsilon_i \quad (2)$$

Equation (2) is the translog of the equation (1) which is decoded by the addition of “ln” after the coefficient of each variable except the dummy variables. Similar  $\beta_0$  is the constant and  $\beta_1, \dots, \beta_9$  are the coefficients of parameters. Model (3) is the direct running of the regression (equation 2), while model (4) is the stepwise OLS regression of equation (2).

## RESULTS AND DISCUSSIONS

The results presented in **table 3 and 4** illustrate factors that can influence the Cambodia household head regarding to the cattle scale using 4 different model from the 2 equations mentioned above in section 2.3. The size of farmers' cultivated land (area) standout to be positive and highly significant at 1% in all the 4 models. It explains that with an increase in cultivated area, the farmers have the tendency to increase the number of their cattle. An increase in the size of cultivated area would mean more feed available for cattle also wider grazing area.

**Table 3: The Regression Result of Model (1) and (2)**

Variable	Model 1			Model 2		
	Coef.	T-Value	P>T	Coef.	T-Value	P>T
<i>edu</i>	-0.226**	-2.14	0.034	-0.169*	-1.76	0.080
<i>age</i>	0.027	1.00	0.317	--	--	--
<i>dum_sex</i>	0.783	0.83	0.410	--	--	--
<i>sizlabor</i>	0.867**	1.94	0.054	0.520*	1.84	0.068
<i>sizchild</i>	0.484	0.95	0.342	--	--	--
<i>sizfami</i>	-0.715	-1.26	0.207	--	--	--
<i>dum_offarm</i>	-0.898	-0.91	0.365	--	--	--
<i>income</i>	0.000	-1.21	0.227	-0.000*	-1.78	0.077
<i>area</i>	0.383***	2.66	0.008	0.390***	2.83	0.005
<i>_Idistrict_2</i>	3.132***	2.67	0.008	2.387**	2.49	0.013
<i>_Idistrict_3</i>	1.040	0.90	0.367	--	--	--
<i>_Idistrict_4</i>	5.376***	3.86	0.000	4.397***	3.80	0.000
<i>_Idistrict_5</i>	2.835***	2.69	0.008	2.038**	2.46	0.015
<i>_Idistrict_6</i>	1.401	1.16	0.248	--	--	--
<i>_cons</i>	3.445**	1.94	0.054	4.301***	4.18	0.000
No. of obs.	204			204		
R-squared	0.165			0.140		
Adj. R-squared	0.103			0.109		

Not: \*10% level significant; \*\*5% level significant; \*\*\*1% level significant

On one hand, education “*edu*” shows a significant but negatively related to cattle scale in model 1 and 2 with 5 and 10% level of significance respectively while on the other hand, model 4 shows that age is significant and positively correlated with the scale of cattle the farmer choose to keep. A plausible explanation to the negative relationship with education is that majority of the farmers that are young (less experienced) are the ones with higher level of education (above grade 5) while the elderly/aged (more experienced farmers) have better wisdom to taking care of the farm management in the rural areas. Another significant factor which can influence farmer’s decision to change the scale of livestock is the availability or cost of labor: in this study, model 1 and 2 depicts that at the size of labor available in the household could significantly determine the number of cattle to be reared by the household head with each at 10% level of significance. It should be noted that even though other factors are not significant in the model, they still play a vital role in the decision of farmers to adjust the scale of their cattle.

The approximate empirical estimation of the cattle scale among other districts (Banan, MOUNGRUESSEI, Ratanak Mondul, Sangkae, Thma Koul) compared with the base district 1 (Aek Phnum) shows that there are no significant difference with district 3 (MOUNGRUSSEI) for all the models, while district 2 (Banan), district 4 (Ratanak Mondul), and district 5 (Sangkae) proved to be significantly different with about 2 – 4 cattle head.

**Table 4: The Regression Result of Model (3) and (4) by Used Logarithm Type**

Variable	Model 3			Model 4		
	Coef.	T-Value	P>T	Coef.	T-Value	P>T
<i>lnedu</i>	-0.104	-1.03	0.305	--	--	--
<i>lnage</i>	0.025	0.11	0.914	0.399**	2.61	0.010
<i>dum_sex</i>	0.046	0.27	0.784	--	--	--
<i>lnsizlabor</i>	0.200	1.04	0.302	--	--	--
<i>lnsizchild</i>	0.032	0.2	0.840	--	--	--
<i>lnsizfami</i>	-0.512	-1.37	0.174	--	--	--
<i>dum_offarm</i>	0.088	0.53	0.595	--	--	--
<i>lnincome</i>	0.023	0.64	0.523	--	--	--
<i>lnarea</i>	0.261***	3.35	0.001	0.223***	3.68	0.000
<i>_ldistrict_2</i>	0.619***	3.44	0.001	0.335***	2.68	0.008
<i>_ldistrict_3</i>	0.210	1.07	0.288	--	--	--
<i>_ldistrict_4</i>	0.815***	3.69	0.000	0.397***	2.85	0.005
<i>_ldistrict_5</i>	0.510***	3.19	0.002	0.251**	2.33	0.021
<i>_ldistrict_6</i>	0.363**	2.04	0.044	--	--	--
<i>_cons</i>	1.575**	1.91	0.059	-.0664	-0.12	0.907
No.of obs.	120			152		
R-squared	0.244			0.199		
Adj. R <sup>2</sup>	0.167			0.171		

Not: \*10% level significant; \*\*5% level significant; \*\*\*1% level significant

## CONCLUSIONS AND RECOMMENDATIONS

The influence on cattle scale as a result of rice farmers’ behavior in 6 districts of Battambang province of Cambodia was analyzed in this study using two equations and each with two different models. The models depicted one common factor (the size of cultivated land) being highly significant and positively related to the scale of cattle raised by farmers in the region. In other words the larger the farm size the more incline the farmer is to increase the scale of cattle. Other important factors significantly affecting the cattle scale includes the age of the household head, the number of laborers in the family and education of the household head.

According to the result drawn from this study, cropping and grazing area as shown in this study is of paramount important to cattle rearing and as a result of limited area available for grazing or over-grazing of the available areas, this study recommend a land policy which will occasionally allow farmers to graze on condition of paying little stipend in periods experiencing scarcity of forages. Although private investment on agricultural land can go a long way to accelerate efficient agricultural land use for effective development in the sector; the nation's current economic land concession should be closely monitored and cancel the concessionary contracts that fail to meet standard so as to relief more land for farmers. Extension services should concentrate on orienting the farmers on how to capitalize on mix farming to optimize their productivity in both crop and livestock. Education is an important indicator for development both the young and the aged farmers should be encouraged by proving some level of free training and/or education.

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